Research and Application of Agricultural Internet of Things Technology in Intelligent Agriculture

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Abstract. China's modernization of agriculture has been accelerating, the Internet of things and other high-tech level of rapid improvement, and intelligent agriculture is the main direction of modern agriculture. Firstly, this paper summarizes the technology of Internet of things and intelligent agriculture, and summarizes the intelligent technology and internet technology applied in the control process of agricultural production in the process of intelligent agriculture Through listing: Intelligent Agricultural Monitoring System based on Onenet Open Platform, intelligent agricultural irrigation system based on Internet of things technology, apple tree pest control expert system based on Internet of things, practical cases of agricultural product marketing platform based on Internet of things, the paper studies the application of Internet of things technology in Environmental Monitoring, irrigation, pest control, and marketing of agricultural products. In order to provide theoretical basis for farmers.

Keywords. Agricultural Internet of things, intelligent agriculture, Internet technology

Central Document No. 1 of 2019 states that a digital rural strategy should be implemented to expand the demonstration application of the Internet of things in agriculture. The technology of the Internet of things is in itself a highly reliable technological tool that can provide a lot of help for the implementation of agricultural and intelligent concepts. The first document also pointed out the need to speed up breakthroughs in key agricultural core technologies, implement actions to tackle key agricultural core technologies, and promote independent innovation in areas such as smart agriculture. Nowadays, China has a certain industrialization foundation and related technology in the process of developing intelligent agriculture by using Internet of things. However, there are still many deficiencies in the standard system and key technologies of the Internet of things in intelligent agriculture. In the near future, the intelligent agriculture constructed by using the Internet of things technology will certainly change the development mode of traditional agriculture, make modern agronomy flourish.

1. Internet of things technology and intelligent agriculture overview

1.1 Internet of things for agriculture

The Internet of things embodies "the connection of things" with multiple ways of interconnecting, which can be sensed by sensing devices or RFID tags, and information transmission or automatic control by communication technology, even though cloud computing, big data and other new technologies to achieve remote sensing and control, mass data analysis. In 1998, Mit came up with the concept of the Internet of things, which became known as the EPC system. In 2005, the International Telecommunication Union released its "2005 ITU INTERNET REPORT: The Internet of things" which pointed to the advent of the Internet of things era. Agricultural Internet of things is a kind of internet of things controlled by new technology, which can provide scientific basis for modern agriculture and realize the goal of increasing yield, optimizing products and improving benefit.

1.2 Smart farming

Smart Agriculture is an advanced stage of agricultural production, an important component of smart economy, and a concrete embodiment of its form in agriculture. It is conducive to the eradication of poverty in developing countries, the realization of late-development advantages and catch-up strategies. Intelligent agriculture is the application of modern information technology, integrating computer, Internet, Internet of things, wireless communication and 3S technology, to implement visual remote diagnosis, monitoring and monitoring of agricultural production, then the whole process of agricultural production for fine, systematic, scientific management to promote the healthy and sustainable development of agricultural economy.

2. The status of intelligent agriculture based on the Internet of things

2.1. Status of intelligent agriculture abroad

The typical representative of intelligent agriculture in the United States, on the one hand, uses the satellite to monitor the agricultural resources comprehensively, and transmits the monitoring data real-time to the related departments, carries on the scientific overall plan to the agriculture; On the other hand, the agricultural information platform covering the whole country has been established to automatically monitor the agricultural ecological environment, improve the operational efficiency and maintain the sustainable development of the agricultural ecological environment. The government of Japan attaches great importance to the development of the Agricultural Internet of things and has incorporated the Agricultural Internet of things into its plans. The Internet of things for agriculture will reach 58 billion to 60 billion yen by 2020, he said. In addition, the Japanese government also plans to use the Internet of things in agriculture as a source of information within 10 years to promote agricultural robots.

2.2. Current situation of intelligent agriculture in China

Due to the nature of China's development is a large agricultural country, so the domestic application of the Agricultural Internet of things is very significant. At present, China's intelligent agriculture research and development has begun to take shape, standardized technology and application process is relatively mature. Some developed agricultural regions in China use the Internet of things technology to monitor agriculture and feed back the relevant data to the Ministry of Agriculture in time, which can help the Ministry of Agriculture to make decision under the guidance of science and rationality, thus improving the decision-making level of the Ministry of Agriculture; In the rest of the underdeveloped agricultural areas, most farmers have only heard about the concept of the Internet of things in agriculture, but do not have a deep understanding of it. Relevant departments have also actively organized farmers to use new technologies to analyze, integrate and share information, to realize the transformation of agriculture, so as to greatly improve its production efficiency, stabilize and even increase the income of farmers. Due to the late implementation of intelligent agriculture based on the Internet of things (Iot) in China, some fields still need to be improved.

3. Internet of things technology in intelligent agriculture

3.1. Wireless network technology

Wireless network technology is used to connect the network and electronic equipment, so as to achieve information and data network dissemination. The wireless network technology is the most extensive technology in the application of the Internet of things technology in the intelligent agriculture, in the application of intelligent agriculture, agricultural production information can be transmitted and perceived. Some sensors and electronic devices rely on Wireless Network Technology for information collection and recognition in agricultural production, therefore, wireless network technology is the basis of developing intelligent agriculture and applying Internet of things technology.

3.2. Radio Frequency Identification Technology

Radio Frequency Identification Technology, known as RFID technology, is the primary communication technology in the application of the Internet of things technology through the use of multiple frequency bands of radio signals for monitoring and identification operations, and records the collected information, its application field mainly lies in the short distance information recognition work. It consists of a software system, a reader and a transponder, and has the advantages of high efficiency, good stability, strong anti-interference ability and large capacity. It plays an important role in the application of the Internet of things technology, and widely used in the construction process of intelligent agriculture.

3.3. Sensor network technology

The application of Sensor Network Technology is to construct a network structure with multiple sensors connected by communication cables, so as to process, transmit and collect the data in the area. In the process of building intelligent agriculture, using the method of building sensor network system can effectively manage and contact the sensors, so the environment adaptability, data information processing efficiency and data information collection efficiency of the sensor are improved. It is one of the main contents of intelligent agriculture that the sensor network system can link and exchange information among all aspects of intelligent agriculture, so as to improve the intelligent degree of agricultural production.

4. The application of Internet of things technology in intelligent agriculture

4.1. Environmental monitoring case: intelligent agriculture monitoring system based on onenet open platform of internet of things

1) system architecture design

The OneNET platform is chosen as the core of the whole system, which has three functions: Data Acquisition, Data Collection and storage, data visualization and display. On this basis, the monitoring system for intelligent agriculture is designed with the data transmission function of 4G-DTU module and the data acquisition device for the data acquisition function of crop growing environment.

- crop growing environment acquisition device: In view of the temperature and humidity data acquisition in facility agriculture, rs-n01-8 temperature and humidity transmitter of Jiandairenke company is selected as the data acquisition device of crop growing environment.
- 4G-DTU module: The main function of 4G-DTU module is to establish the data path between OneNET platform and data acquisition device of crop growing environment.
- OneNET platform: OneNET is an open Internet of things platform launched by China Mobile Internet of things, a subsidiary of China Mobile. Its main services can be divided into basic services and value-added services.

2) system configuration

RS-WS-N01-8 temperature and humidity transmitter configuration, USR-G7814G-DTU configuration and test, OneNET platform configuration.

3) summary

In recent years, the development of facility agriculture technology has greatly improved the unit yield and quality of crops. Based on the traditional data acquisition device of crop growing environment, the intelligent agriculture monitoring system is designed with the open platform of Internet of things. The system is aimed at intelligent agricultural monitoring, and crop managers can obtain real-time crop growth environment data via the Internet via devices such as smart phones, on this basis, feedback control is used in combination with traditional agricultural technology, and information and automation are used to intelligently control the growing environment of crops in facility agriculture, it provides a strong technical guarantee for the further development of intelligent agriculture.

4.2. Agricultural irrigation application case: application of intelligent irrigation system based on internet of things

1) design of intelligent irrigation system

Theoretical Model: First of all, crop transpiration in the course of daily growth, based on this for irrigation water control. Taking soil moisture as the key index, choosing the difference value of soil moisture and the change rate of the difference value in different time as the input variable, through strategy control, setting multi-language variable to form the mold and the control rule, the MODEL and control theory of agricultural intelligent irrigation system are established.

2) system configuration

The control device STM is set up in the field, the power supply and reset function are provided by the power supply system, and the intelligent irrigation information communication is realized by the coordination of GSM/GPRS and Ethernet. The core control device is composed of solenoid valve, frequency converter and various sensor devices. The soil moisture sensor connected with STM integrates the signal into the field intelligent control executive device after processing, receiving and sending, complete a round of intelligent irrigation control and regulation.

3) system software control

The software control program is programmed for the intelligent irrigation system controlled by the Internet of things, including initialization, parameter definition, temperature and humidity control, motor control, opening and closing of each valve and pump, etc. , at the same time, it includes the visual display screen configuration design of intelligent irrigation system.

4)summary.

The application of intelligent irrigation system in agriculture is analyzed, and the intelligent irrigation control model is established based on the core control technology of Internet of things in agriculture. Based on the technology of Internet of things transmission and control, the experiment of a complete agricultural intelligent irrigation system was carried out, and the soil moisture, air temperature and irrigation water demand were selected as the evaluation parameters of the system, the design is feasible and the test system runs stably.

4.3. Pest control application case: an expert system for apple tree pest control based on the Internet of things

1) system principles.

It is based on the Internet of things (Iot) sensing technology, transmission technology and processing technology, combined with expert system software, using SQLsereve2005 database for data original accumulation or storage in the final conclusions of data. The system makes decision, selects, diagnoses and presents the diagnosis results to the users, who can visit the service station at any time according to their needs, in order to realize the intelligent identification, location, monitoring and management of the pest control.

2) methodology and subjects.

Aiming at the perfection of apple field management technology, the design and application data model of Apple Tree pest control expert system based on Internet of things and its feasibility analysis are put forward, it provides a preliminary reference for the popularization and application of Internet

of things technology in apple industry. Through the intervention experiment on the apple trees planted in the farmer's orchard in the main apple producing area, that is, two plots a and B in the farmer's orchard were selected to carry out the intervention, 0.5 Mu of plot a is monitored and maintained by Internet of things technology, and 0.5 mu of plot B is maintained by routine maintenance, the age, variety, geographical position, yield and quality of apple trees in the two groups were almost the same. The yield per tree, the yield of high quality fruit, the input cost and the final profit were compared.

3) summary.

The design and application of the expert system for the prevention and control of apple tree diseases and insect pests based on the Internet of things can complete the monitoring of the growth of fruit trees and fruits all day long and realize the tracking and analysis of the occurrence and development of fruit tree diseases and insect pests, and according to the expert system diagnosis opinion carries on the early intervention, reduces the fruit tree disease and insect pest occurrence, eliminates or reduces the pesticide use, for develops the green pollution-free organic fruit, enhances the apple quality and the yield to create the condition, has the impetus function regarding the local industry development. With the introduction of various information storage devices and technologies, the Internet of things can cache or save the environmental information in many ways to support different forms of query and analysis. Various types of wireless networks provide convenient access to the network, which is an important infrastructure for the realization of the Internet of things. Under this situation, it is necessary to create a more convenient agricultural monitoring environment to promote the development of high-yield and fine agriculture.

4.4. Agricultural marketing applications: an internet of things based agricultural marketing platform

1)system design.

Based on the platform of agricultural products marketing network of Internet of things, this system adopts b/s browser server mode to design and develop. The advantage of b/s architecture is that the server is used to deal with all the business, the administrator only manages the server to realize the management of the whole system, which is convenient for the upgrade and maintenance of the system software, and greatly reduces the Labor intensity of the administrator, it is beneficial to the safe and stable operation of the system.

2) module design

- agricultural product sales feedback management module: Record each agricultural product sales in the market, can design a sales curve within a year, according to the sales curve can analyze the average monthly sales, make production decisions based on sales volume.
- agricultural products sales and tracking management module: Complete the record of agricultural products production status, storage status and logistics tracking status.
- agricultural products pre-order management module: to complete the agricultural products on-line pre-order agricultural products customers, at the same time to provide online sales staff agricultural products order information.
- agricultural product order management module and Agricultural Product Report Form Management Module: Complete the functions of order receiving, order processing and order charging, which can monitor the real-time financial affairs of the distribution organization, and the internal sales of the enterprise can reconcile accounts in time.
- agricultural reporting module: The production of daily, monthly and annual reports is realized, which analyses the daily, monthly and annual production and sales of agricultural enterprises, and generates the annual production and sales analysis curve, for Enterprise Analysis.

3) summary.

Agricultural product production enterprise is a kind of organization between industry and Agriculture, and is the core link of agricultural industrialization in our country. Therefore, it is very necessary to study the management of agricultural production enterprises. In recent years, with the rapid development of economy and science and technology, the manual management of agricultural products can not meet the development of agriculture and enterprises, so it is necessary to develop a

marketing platform of agricultural products based on Internet of things, this paper designs an agricultural product marketing platform based on Internet of things. The practice proves that the platform will greatly improve the efficiency of agricultural product marketing.

5. Problems

5.1. 1immature infrastructure.

At present, China's agricultural internet of things technology applications are limited, there is no good information infrastructure, Internet of things technology is Zhao Kuo, can not stand too many tests, this has greatly affected the farmers access to agricultural products in real time, limits their ability to direct the production process of agricultural products. The application of intelligent agriculture under the Internet of things framework lacks relative standard system, the product structure and function are relatively single, it can not be intelligentized and supported by no data model, and the implementation of technology has not kept pace with the basic principles of agriculture, the Internet of things in agriculture is slowing down.

5.2. Insufficient funding.

China's intelligent agriculture is at the primary stage of development, and it is difficult to achieve the level of developed countries by relying only on financial support; it is also difficult to achieve if we rely too heavily on the market to achieve intelligent agriculture, the "invisible hand" and the "visible hand" should be properly coordinated. Secondly, the lack of standard certification of intelligent agricultural products, agricultural products traceability system without authority certification, consumer products are not recognized, resulting in the establishment of a perfect agricultural products system.

5.3. Shortage of technical and professional staff.

Labor Force has always been the focus of development in all walks of life, the lack of professional agricultural technicians is one of the human resources factors that hinder the development of intelligent agriculture. Nowadays, most of the graduates choose to stay in the big city for their ideal, few of them go back to their hometown to develop, which makes the rural areas dominated by the old and the young and the middle-aged lack. At present, there is an urgent need to establish a demonstration base, cultivate agricultural technical personnel, better improve the technology of Internet of things in agriculture, continue to explore the core technology of Internet of things in agriculture. There is a shortage of personnel in research, development, use, extension, training and equipment maintenance. Agricultural Enterprises, cooperatives and large farmers are the users of agricultural iot technology, and their ability to operate the IOT system is insufficient.

6. Conclusion

In recent years, due to the rapid development of China's social economy and the continuous provision of scientific and technological level, the use of high and new technology has made rapid development in all walks of life. Nowadays, China's agriculture is changing from traditional agricultural operations to modern agricultural operations, and intelligent agriculture is the main development direction of modern agriculture. The basic condition and core technology of building intelligent agriculture is the use of Internet of things technology, so internet of things technology has a very important position in the process of developing intelligent agriculture. The use of Internet of things technology can effectively ensure the automation and intelligentization of agricultural production, not only improve the quality of agricultural products and production efficiency, but also promote the rapid development of intelligent agriculture, ensuring the sustainable development of agriculture. This paper discusses the existing problems and development strategies of intelligent agriculture under the framework of Internet of things at the macro level, and its development process should be adapted to local conditions as far as possible, so as to promote the comprehensive and real-time development of the application of

new technologies in modern agriculture, it also helps to further promote the sustainable development of China's agriculture, laying a foundation for farmers to increase production and income, and providing a strong support for the development of modern agriculture. As a big agricultural country, China should also absorb foreign countries, take its essence, combine the actual situation of our country to work out the Internet of things intelligent agriculture system. The development of Internet of things provides an unprecedented opportunity for accelerating the realization of Chinese agricultural wisdom, which will have a profound impact on the future of modern agriculture.

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